

Abstract

The present invention provides methods for achieving substantially damage-free material deposition using charged particle (e.g., ion, electron) or light beams for generating secondary electrons to induce deposition in a gas deposition material.

Among other things, some of the methods can be used to deposit, with satisfactory throughput, a protective layer over a semiconductor feature without significantly altering the feature thereby preserving it for accurate measurement. In one embodiment, the beam is directed onto an electron-source surface next to the target surface but not within it. The beam is scanned on the electron-source surface causing secondary electrons to be emitted from the electron-source surface and enter the region over the target surface to interact with deposition gas for depositing a desired amount of material onto the target surface. In this way, materials can be deposited onto a the target surface at a suitably high rate without having to expose the target surface, itself, to the beam being used to perform the material deposition. In another embodiment, the beam is directed onto a separate electron generating surface (preferably one that has a relatively high secondary electron emission coefficient) proximal to the target surface for generating the electrons to deposit the deposition material onto the target surface.